

Exhibit A
Scope of Work
Regents of the University of California, Berkeley

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR¹	Task Name
1		General Project Tasks
2		PEV Smart Charging User Needs Assessment
3	X	OpenVBOSS Module Scoping, Development, and Testing
4		Distribution-Level Utility Power Grid Impacts and Benefits Analysis of PEV Smart Charging Using OpenVBOSS
5		Analysis and Forecast of Ratepayer Benefits of Open Source PEV Smart Charging in California IOU Territories (2015-2030)
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
BMW	Bavarian Motor Works
BOSS	Building Operation System Services
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
EVSE	Electric Vehicle Service Equipment
IOU	Investor-Owned Utility
OPHS	Office for the Protection of Human Subjects
OpenADR	Open Automated Demand Response
OpenVBOSS	Open Vehicle and Building Operation System Services
PEV	Plug-In Electric Vehicle
PG&E	Pacific Gas & Electric
SEP2	Smart Energy Profile 2.0
TAC	Technical Advisory Committee
UC	University of California
WECC	Western Electricity Coordinating Council

¹ Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

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II. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this Agreement is to fund the development, testing, and associated analysis of an open-architecture, secure data-stream system for plug-in electric vehicle (PEV) smart charging for optimized grid operations in a local control setting. The intent of the system is to be widely applicable to different residential and small commercial business settings, with emphasis on open source code and architecture, careful consideration of user needs, and minimum costs of implementation.

B. Problem/ Solution Statement

Problem

The proposed project addresses the key problem of access and signals/controls for local data streams in order to control electricity systems loads for grid management. PEVs are proliferating in California under the Advanced Clean Cars Program, sometimes in geographic clusters, creating potential load management issues for electrical utility grids at the feeder and transformer level. Strategies exist to coordinate and manage these loads through low-cost, open source and architecture platforms for PEV load control, with minimal barriers to implementation and equal data security to more closed systems.

Without a major “state change” to the prominence of such open-software platforms, many competing proprietary interests will attempt to promote their proprietary systems. However these will come with attached user/licensing fees, greater barriers to adoption, and restricted overall potential impact on improving grid operations and helping to improve the acceptance of renewable energy resources as they are further expanded in the California grid mix.

Solution

The Recipient will develop an open-source, open-architecture software platform known as “Open Vehicle and Building Operation System Services” (OpenVBOSS), designed to be implemented at local residential and small commercial settings with minimal costs of implementation to achieve key utility grid support goals. The project would be fully cognizant of past and current efforts to develop communication standards and protocols such as Open Automated Demand Response (OpenADR), Smart Energy Profile2.0 (SEP2), Zigbee, Society of Automotive Engineers J1772, International Standards Organization 15118, etc.) but itself would be accommodating of a wide range of potential protocols and data stream requirements. This project addresses a critical need for the promotion of open-source platforms for PEV load control, focusing on the residential and small commercial level.

The software platform will be developed in conjunction with user needs assessments from the BMW North America LLC i ChargeForward pilot program, assessments of control algorithms for grid feeder loading through PEV charge control, types of control signals that may be utilized (e.g. from local utility grid or California Independent System Operator) and data safety/security considerations. Additional project considerations will be included for assessing system-wide

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benefits of PEV charge control in a 2015-2030 scenario and mechanisms for returning grid values back to users based on overall grid and system benefits calculations. The OpenVBOSS software platform code and project documentation will be widely disseminated through the project reports, professional conferences, journal publications, and other distribution means.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Further the development of open-architecture solutions for PEV smart charging to maximize potential benefits for grid operation and ratepayer benefit.
- Advance the state-of-the art in understanding user needs for smart charging systems based on their real-world experiences.
- Identify low-cost and high ease of implementation systems that can capture significant grid operational value through PEV smart charging, taking advantage of “autonomous/local control” architectures through local building automations systems rather than through more rigid “centralized-control” concepts, and with a high level of interoperability and forward compatibility.
- Widely disseminate project results in the promotion of open-source, open-architecture control platforms that can integrate with many different existing and future communications protocol interfaces.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of: greater electricity reliability and lower costs by reducing potentially strained transformers and feeder circuits at the distribution level; providing better potential throughput through existing power grid nodes by allowing for better coordination of PEV loads and; allowing PEV loads to be deployed to help manage the issues created by the increasing level of intermittent power generation expected to be integrated into California’s grid under the state Renewable Portfolio Standard program.

Greater electricity reliability will be achieved by allowing utilities and grid operators the opportunity to control PEV charging loads with exact knowledge of the location of the vehicle’s electrical connection relative to the local feeder and transformer network, helping to avoid conditions of grid overload when PEVs cluster along feeder networks. The project also offers the ability to help vehicles provide additional grid services in “virtually aggregated” clusters, such as local voltage and frequency support, fast ramping capability, and potentially an even broader set of grid services such as reactive power compensation. Many of these services can be employed with simple, easy to implement concepts that only involve modulation of one-way power to the vehicle, rather than somewhat harder to implement “vehicle to grid” power concepts that involve bi-directional power flow. Lowered costs for ratepayers will be realized through these improvements in system operation, translating to lowered “rate based” costs that

² California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC “Phase 2” Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

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can be passed along to ratepayers. Direct participants (PEV owners) in PEV load control programs may also expect to receive direct incentives, such as participation payments, for their participation, providing additional benefits to those system users.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by advancing the development of easily-implementable solutions to control the charge and ease grid impacts of PEV adoption, reducing strains on electrical grids, allowing for system upgrade deferrals, improving grid operational efficiency, and ultimately reducing the costs to ratepayers of maintaining California's evolving electrical grid. The project will also help to identify means and mechanisms for returning realized grid values through better management of PEV load control to users for their direct participation, along with additional benefits that accrue to all ratepayers. These direct incentives to "smart charging" participants could help to improve the PEV value proposition and lead to enhanced adoption of PEVs over time to help meet the goals of California's Advanced Clean Cars program and Assembly Bill 32 Cap-and-Trade Program, as well as local air pollution reduction goals.

Agreement Objectives

The objectives of this Agreement are to:

- Scope, develop, and test the OpenVBOSS "smart charging" software platform;
- Conduct associated user needs assessments based on actual participation in smart charge pilot programs;
- Conduct California system feeder-level grid operational benefits analysis;
- Conduct overall grid and ratepayer benefits analysis;
- Conduct evaluation of project benefits; and
- Develop technology and knowledge transfer activities.

TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. Products that require a draft version are indicated by marking "**(draft and final)**" after the product name in the "Products" section of the task/subtask. If "**(draft and final)**" does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, "**days**" means working days.

³ California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

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The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

- Submit all data and documents required as products in accordance with the following:

Instructions for Submitting Electronic Files and Developing Software:

○ **Electronic File Format**

- Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
- Documents intended for public distribution will be in PDF file format.
- The Recipient must also provide the native Microsoft file format.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

○ **Software Application Development**

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Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
- Microsoft SQL Reporting Services. Recommend 2008 R2.
- XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other Energy Commission staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The administrative portion of the meeting will include discussion of the following:

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
- An updated Project Schedule;
- Technical products (subtask 1.1);

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- Progress reports and invoices (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide an *Updated Project Schedule*, *List of Match Funds*, and *List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Updated Project Schedule (*if applicable*)
- Updated List of Match Funds (*if applicable*)
- Updated List of Permits (*if applicable*)

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

The goal of this subtask is to determine if the project should continue to receive Energy Commission funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the Energy Commission and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient, and may include the CAO and any other individuals selected by the CAM to provide support to the Energy Commission.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.

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- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

CAM Products:

- CPR Agenda
- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.

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- Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
 - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
-
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
 - Prepare a *Schedule for Completing Agreement Closeout Activities*.
 - Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:

- Progress Reports
- Invoices
-

Subtask 1.6 Final Report

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The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM. (See *Task 1.1* for requirements for draft and final products.)

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:
 - Cover page (**required**)
 - Credits page on the reverse side of cover with legal disclaimer (**required**)
 - Acknowledgements page (optional)
 - Preface (**required**)
 - Abstract, keywords, and citation page (**required**)
 - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
 - Executive summary (**required**)
 - Body of the report (**required**)
 - References (if applicable)
 - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
 - Bibliography (if applicable)
 - Appendices (if applicable) (Create a separate volume if very large.)
 - Attachments (if applicable)

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- Ensure that the document is written in the third person.
 - Ensure that the Executive Summary is understandable to the lay public.
 - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
 - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
 - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
 - Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
 - Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
 - Include a brief description of the project results in the Abstract.
-
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
 - Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
 - Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
 - Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

- Final Report (draft and final)
- Written Responses to Comments on the Draft Final Report

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

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The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
 - A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter (*if applicable*)
- Match Funds Reduction Notification Letter (*if applicable*)

Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:

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- A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
- The schedule the Recipient will follow in applying for and obtaining the permits.

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)
- Updated Schedule for Acquiring Permits (*if applicable*)
- Copy of Each Approved Permit (*if applicable*)

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts (*draft if required by the CAM*)

TECHNICAL ADVISORY COMMITTEE

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Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
 - Technical area expertise;
 - Knowledge of market applications; or
 - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

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- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

III. TECHNICAL TASKS

TASK 2 PEV Smart Charging User Needs Assessment

The goal of this task is to conduct a detailed assessment of user needs associated with PEV smart charging control systems given the unique nature of automobiles and mobility in people's daily lives. The task will draw directly on the PG&E/BMW "ChargeForward" pilot project by translating lessons learned and other key user aspects into related project tasks.

The Recipient shall:

- Establish a BMW i ChargeForward program participant *Focus Group Interview Protocol* with BMW (expected 60 participants in six 90-minute sessions).
- Obtain University of California (UC) Berkeley consent to operate focus groups under Office of the Protection of Human Subjects Protocols (OPHS), resulting in *Focus Group Human Subjects Protocol Approval Documentation*.
- Conduct literature assessment of international efforts to explore user-needs aspects of utility-controlled and building-integrated PEV charge control systems resulting in a *Utility Controlled Charging Literature Assessment Report*.

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- Execute focus groups in a set of 5-6 sessions with up to 12 participants in each session (expected 60 total participants), with completion documented in a *PEV Driver Focus Group Overview Report* that documents the number of focus group sessions held, date/time of each session, and the total number of participants.
- Conduct additional interviews with building managers to explore potential willingness to accept managed PEV charging at small commercial settings (12-15 interviews) resulting in a *Building Manager PEV Charging Acceptance Report* for inclusion in the Final Project Report.
- Summarize key findings in *Focus Group and Interview Findings Report* for inclusion in the project *Final Report*.

Products:

- i ChargeForward Project Participant Focus Group Interview Protocol Document
- Focus Group Human Subjects Protocol Approval Documentation (Written approval from OPHS)
- Utility Controlled Charging Literature Assessment Report
- PEV Driver Focus Group Overview Report
- Building Manager PEV Charging Acceptance Report
- Focus Group and Interview Findings Report (draft and final)

TASK 3 OpenVBOSS Module Scoping, Development, and Testing

The goal of this task is to scope, develop, and test an open-architecture communications and control platform for charge on/off and power modulation for Level 1 and 2 charging power levels. The platform will be capable of interfacing with virtually all known wireless and wired communications concepts, and envisioned for local and “autonomous” peer-to-peer control as well as centralized server-based control concepts.

The Recipient shall:

- Develop a set of key PEV smart charge platform development functional criteria based on user needs, grid operational communication requirements, and other communications (e.g. to building automation systems), resulting in a *PEV Functional Criteria Interim Report*.
- Develop and implement software to beta test platform known as OpenVBOSS in a simulated PEV charging environment, resulting in *Software Development and Implementation Documentation*.
- Install a wireless-enabled Level 2 PEV charger along an existing conduit run adjacent to a UC Berkeley Global Campus at Richmond Bay building for purposes of system testing:
 - Obtain formal campus approval.
 - Select and procure charger unit.
 - Provide contract to licensed Electric Vehicle Installation Training Program certified electrician to perform charger installation.
 - Provide documentation of charger installation to the project CAM in the form of a *PEV Charger Installation Documentation* document.

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- Implement a fully functional version of OpenVBOSS at UC Berkeley Global Campus building setting, adjacent to the Level 2 PEV charger installation resulting in a brief document for *Initial Implementation of PEV Charge Control Software/Hardware Documentation*.
- Informed by Task 2 and Task 4, test and develop OpenVBOSS applications for Level 1 and Level 2 charge control of Electric Vehicle Service Equipment (EVSE) (demonstrated) and “connected vehicles” independent of EVSE control (simulated). Applications will include at least one of the following: a user interface on a mobile device that provides real-time feedback and ability to specify priorities in balancing travel needs with cost, a control application that optimizes vehicle charging for efficient energy use and prolonged battery life, and load management sensitive to whole building loads as well as charger, feeder and substation loads. Task results in an *Interim Report of OpenVBOSS Beta Testing*.
- Document the OpenVBOSS software platform and applications in *Final Implementation of PEV Charge Control Software/Hardware Documentation* for inclusion in Final Project Report.
- Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- PEV Functional Criteria Interim Report
- Software Development and Implementation Documentation
- PEV Charger Installation Documentation
- Initial Implementation of PEV Charge Control Software/Hardware Documentation
- Interim Report of OpenVBOSS Beta Testing
- Final Implementation of PEV Charge Control Software/Hardware Documentation
- CPR Report

TASK 4 Distribution-Level Utility Power Grid Impacts and Benefits Analysis of PEV Smart Charging Using OpenVBOSS

The goal of this task is to better understand the ability of PEV smart charging to help manage and mitigate problems associated with PEV charge “clustering” at the feeder level. Key issues to be examined include physical power delivery constraints based on transformer and conduit loading, transformer degradation issues, and opportunities for system upgrade deferral through more careful load management strategies. Opportunities for PEV charge modulation to provide additional grid benefits with minimal added complexity (e.g. voltage support and reactive power and frequency correction) will also be examined.

The Recipient shall:

- Analyze feeder-level power delivery and quality issues that can be introduced by the additional of PEV loads including load clusters, resulting in preparation of a *PEV Power Delivery and Quality Issues Report*.
- Apply control algorithms of various types to determine the potential efficacy of easily implementable algorithms for PEV charging power management at the community/utility grid feeder scale, including concepts for “virtual aggregation” of vehicle grid services.

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Document task findings in an *Opportunities for Improved Grid Performance through Controlled PEV Charging Report*.

- Develop OpenVBOSS functional specifications inputs based on the identified algorithms and strategies. Document task findings in a *Functional Specifications for Grid Communications for Improved Grid Performance Report*.
- Quantify the potential benefits of PEV charge control for a scenario of PEV implementation overlaid with expectations of distribution level “grid stress” in California investor-owned utility (IOU) territory for an example future year (i.e. 2020). Document findings in a *Potential Distribution System Benefits of PEV Charge Control in California Report*.

Products:

- PEV Power Delivery and Quality Issues Report
- Opportunities for Improved Grid Performance through Controlled PEV Charging Report
- Functional Specifications for Grid Communications for Improved Grid Performance Report
- Potential Distribution System Benefits of PEV Charge Control in California Report

TASK 5 Analysis and Forecast of Ratepayer Benefits of Open Source PEV Smart Charging in California IOU Territories (2015-2030)

The goal of this task is to define the overall system-wide benefits that are possible using the strategies accessible by the OpenVBOSS platform architecture over a scenario period from 2015 through 2030 in California IOU service territory. These benefits will be assessed in relation to California’s aggressive Renewables Portfolio Standards, and evolving requirements for grid support services associated with the integration of intermittent renewable resources in the context of the evolving grid generation mix.

The Recipient shall:

- Develop scenarios of California grid generation mix and “realistic” PEV market penetration from 2015 through 2030 resulting in a *PEV Market Penetration Estimate Report* that will include discussions on the following, but not limited to:
 - Analytical efforts to study and project the California PEV market.
 - Information to develop a range of scenarios to project PEV market penetration.
 - Projected PEV load growth and potential demand response program opportunities.
- Estimate the broad potential for PEV smart charging to assist in accepting intermittent renewable energy in cost effective ways compared with “next best” solutions such as stand-alone grid storage or turning down “marginal” baseload generation using the SWITCH model framework. SWITCH is a grid simulation model developed at UC Berkeley that is free and open-access software. A version of SWITCH known as SWITCH-WECC has been adapted to the synchronous region of Western Electricity Coordinating Council (WECC), which encompasses 11 western US states, two Canadian provinces and northern Baja Mexico. Task results in preparation of a *Potential System-Wide Benefits of PEV Controlled Charging in California Report*.

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- Identify mechanisms for generated grid support values from PEV smart charging to be returned to vehicle drivers and ratepayers. Document task finding through preparation of a *Mechanisms to Return Grid Support Values to Vehicle Drivers and Ratepayers Report*.

Products:

- PEV Market Penetration Estimate Report
- Potential System-Wide Benefits of PEV Controlled Charging in California Report
- Mechanisms to Return Grid Support Values to Vehicle Drivers and Ratepayers Report

TASK 6 Evaluation of Project Benefits

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
 - For Product Development Projects and Project Demonstrations:
 - Published documents, including date, title, and periodical name.
 - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
 - Greenhouse gas and criteria emissions reductions.
 - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
 - Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.
 - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
 - Investment dollars/follow-on private funding as a result of Energy Commission funding.

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- Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
 - Outcome of demonstrations and status of technology.
 - Number of similar installations.
 - Jobs created/retained as a result of the Agreement.
- For Information/Tools and Other Research Studies:
 - Outcome of project.
 - Published documents, including date, title, and periodical name.
 - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.
 - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
 - An estimate of energy and non-energy benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires with formal *Questionnaire Question Responses*.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire
- Questionnaire Question Responses

TASK 7 Technology/Knowledge Transfer Activities

The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:

- Prepare an *Initial Project Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:

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- An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
- A description of the intended use(s) for and users of the project results.
- Published documents, including date, title, and periodical name.
- Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
- A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
- The number of website downloads or public requests for project results.
- Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the *Technology/Knowledge Transfer Plan*. These activities will be reported in the *Project Progress Reports*.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop on the results of the project.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Project Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Technology/Knowledge Transfer Plan (draft and final)
- Report of Technology/Knowledge Transfer Plan Activities (in Project Progress Reports)
- Presentation Materials (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

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IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: UNIVERSITY OF CALIFORNIA, BERKELEY

RESOLVED, that the State Energy Resources Conservation and Development Commission (Energy Commission) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

RESOLVED, that the Energy Commission approves Agreement EPC-15-013 from PON-14-310 with The Regents of the University of California, on behalf of the Berkeley campus, for \$1,500,000 grant to develop an advanced smart charging technology that maintains plug-in electric vehicle consumer needs while reducing charging loads, to achieve electricity grid benefits; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on February 10, 2016.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Tiffani Winter,
Secretariat